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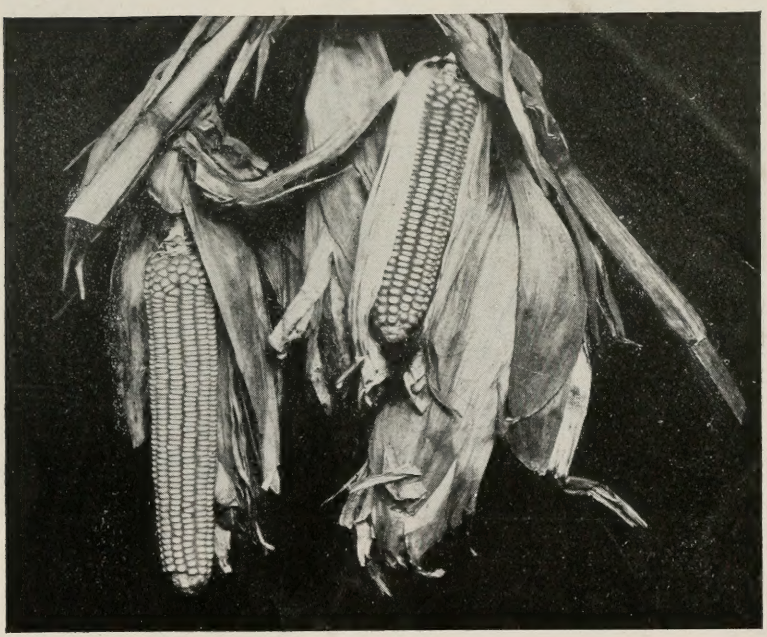
# A CORN CATECHISM



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COLUMBUS

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# An Invitation to the Country

Already, close by our summer dwelling,
  The Easter sparrow repeats her song;
A merry warbler, she chides the blossoms—
  The idle blossoms that sleep so long.

The bluebird chants, from the elm's long branches,
  A hymn to welcome the budding year.
The south wind wanders from field to forest,
  And softly whispers, "The Spring is Here."

* * * * *

Though many a flower in the wood is waking,
  The daffodil is our doorside queen;
She pushes upward the sward already,
  To spot with sunshine the early green.

No lays so joyous as these are warbled
  From wiry prison in maiden's bower;
No pampered bloom of the green-house chamber
  Has half the charm of the lawn's first flower.

Yet these sweet sounds of the early season,
  And these fair sights of its sunny days,
Are only sweet when we fondly listen,
  And only fair when we fondly gaze.

There is no glory in star or blossom
  Till looked upon by a loving eye;
There is no fragrance in April breezes
  Till breathed with joy as they wander by.

* * * * *

—William Cullen Bryant.

# A CORN CATECHISM.

## Is it Possible to Raise One Hundred Bushels or More of Corn per Acre under Ohio Conditions?

Yes. The official records of the Ohio Corn Improvement Association show that under good management an entire field can be made to average *more* than one hundred bushels per acre. In nearly every community in Ohio there are a few farmers who obtain yields of from 60 to 100 bushels of corn per acre, year after year.

## What are the Conditions Necessary for this Large Yield?

A good soil well manured and properly tilled, good seed, and as nearly a perfect stand of plants as possible.

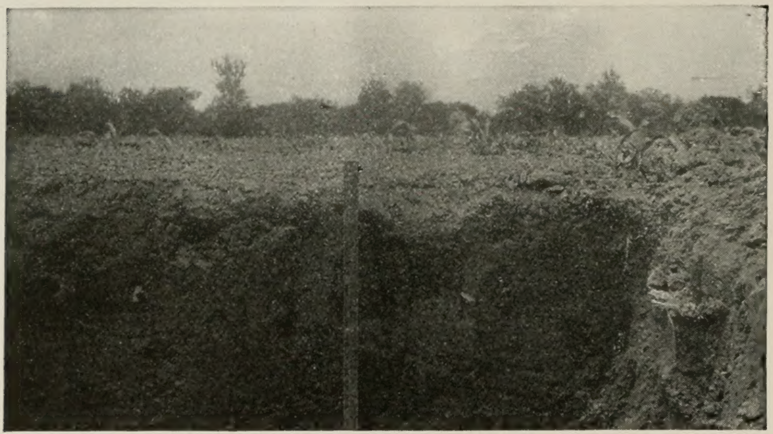


Fig. 1. An ideal seed bed. The furrow slice well pulverized and compacted, the surface fine and loose.

## What Kind of Soil is Best for Corn?

A rich, mellow, loam—thoroughly drained and covered with well rotted stable manure at the rate of 12 to 14 loads to the acre, or a clover sod, top-dressed with 5 to 8 loads of manure—is the best soil for corn. The manure furnishes food for the plants and helps the soil to absorb and hold the early rains until the moisture is needed later in the summer. If the maximum yield is desired, 200 to 300 pounds per acre of a mixture of acid phosphate and muriate of potash in the proportion of six parts of the former to one part of the latter may be used to good advantage. The fertilizer should be drilled in or broadcasted over the surface and harrowed in after the seed bed has been prepared.

## How is a Good Seed Bed Prepared?

The ideal seed-bed, as shown in Fig. 1, can be obtained with expenditure of the least amount of time and energy by practising winter or early spring plowing. If plowing is delayed until the ground is dry and hard, it is practically impossible to reduce and thoroughly pulverize the clods that are sure to be turned up by the plow. Repeated rolling and harrowing may reduce the immediate surface to a fine. mellow condition, but below this layer the clods will persist, as shown in Fig. 2, and the moisture supply will be cut off, since the water cannot rise by capillarity through the large spaces between clods.

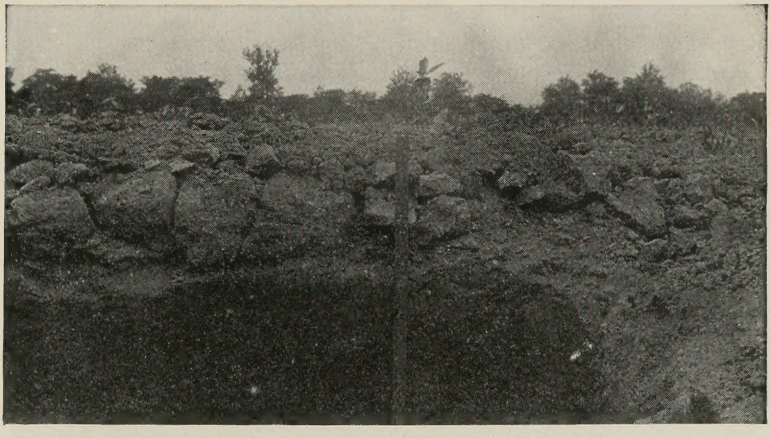


Fig. 2. A poor seed bed, the result of late plowing. Note the clods at the bottom of the furrows.

The moisture supply is sometimes cut off from below by the plowing under of a thick layer of manure, a heavy sod or cover crop of rye. Figure 3 shows how the plowing down of a heavy rye crop late in the spring may prevent the furrow slice from making good contact with the subsoil. Disking the surface of the soil before plowing is a decided help in the preparation of the seed-bed since it helps to pulverize the furrow slice or to cut the sod before it is turned by the plow. When plowing sod or land covered with a heavy dressing of manure, care should be taken to keep the furrow slice from being completely inverted. It is better to have the slice on edge with the sod or manure in a position where it is easily reached by the harrow and disk. To secure an ideal seed-bed, plow early and follow very closely with the roller and harrow. It is good practise to roll and harrow, each morning, the land plowed the day before. A well pulverized, furrow slice with a thin layer of fine loose soil over the surface presents conditions that are favorable for the conservation and proper movement of the soil moisture. When the furrow slice is well pulverized and compact, it makes good contact with the subsoil and offers conditions favorable for the rise of moisture from below. The fine, loose layer at the surface is favorable to the development of the young plant roots, readily absorbs the light rains, and helps to prevent the escape of moisture by evaporation at the surface. Carefully dig up a stalk of corn and if you will look closely you will find, besides the large roots that hold the corn upright, a large number of little thread-like roots passing out into the soil in all directions. These little roots are feeders for the corn plant. They go out into the small spaces between the soil grains and there collect water for the use of the plant. This water, as it passes back through the roots to the stalk, carries with it plant food which it has taken up from the soil.

For most soils it is best to practise deep tillage in the preparation of the seed-bed and shallow cultivation after the crop is planted.

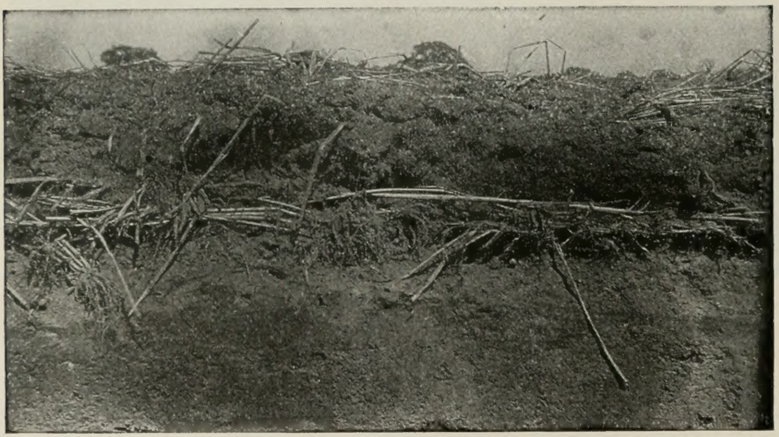


Fig. 3. The result of plowing under a heavy coat of manure or cover crop. Capillarity is completely cut off.

Deep tillage gives the plants a large amount of room in which to send out their roots in search of plant food, allows the soil to drink in the rainfall more freely, and permits the air to enter the soil and help in the preparation of plant food. Shallow cultivation checks the rapid loss of water from the soil by forming a loose blanket over its surface, kills weeds, and helps to admit air to the surface layer of the soil.

Plants are like animals in that they must have food and drink or they soon sicken and die. Animals can move about from place to place and secure their food, but plants must get their food and water by sending their roots out into the soil. The tiny roots which spread out through the soil are busy all of the time taking up water from the soil for the use of the stalk and leaves above. This water, as it goes into the plant through the roots, carries with it the plant food which it has dissolved out of the little soil particles.

Place a lump of salt in a glass of water and stir for a few minutes. The salt disappears, and you will find that the water has a salty taste. The salt has dissolved in the water, and we say that the salt is in solution in the water. All of the food which comes from the soil must be in solution before it can be used by the plant. The water that goes in through the roots passes out through the leaves into the air and leaves the plant food behind to build up the tissues of the plant.

If the soil is hard and lumpy, the little roots cannot penetrate far into it, but must feed near the surface. If we have a deep, mellow seed bed, the roots are encouraged to go deep and gather plant food from a large amount of soil. The plant food in hard, lumpy ground is not easily dissolved. Stirring the soil and breaking up the clods brings the water into contact with more soil surface and hastens the solution of the plant food.

The depth to which the soil should be prepared depends upon the depth to which the plant roots will penetrate. Wheat, oats, and other small grains are shallow rooted, and do not need as deep a seed bed as corn or root crops.

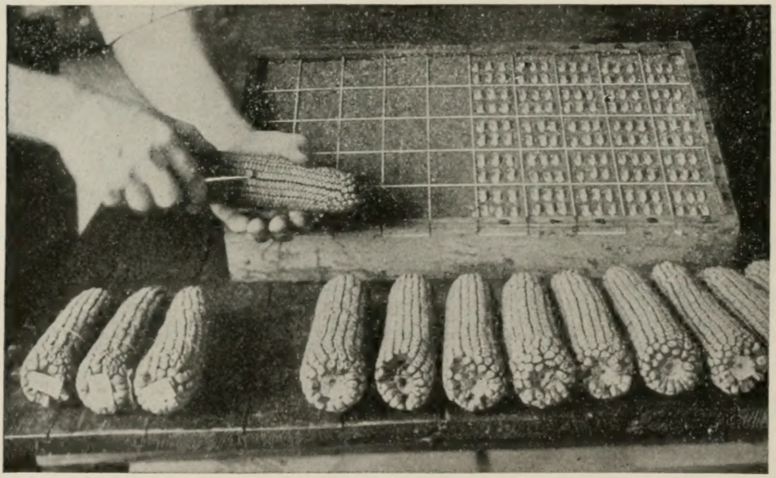
Soils that have always been plowed shallow should be deepened gradually by setting the plow to go about one inch deeper each season until a depth of eight or nine inches has been reached. If this deepening is not done gradually, the soil will be injured and poor crops will result.

## Is Good Seed Important?

It matters not how much food is available to the plants, how well prepared the seed bed, or how great the amount of moisture conserved, the best results cannot be obtained unless good seed is planted Heretofore, much more rapid advancement has been made toward better cultural methods than toward the securing of good seed. Many have never stopped to consider what constitutes good seed. In good seed there must be stored in the germ that which we call life, or, as we commonly say, the seed must have vitality. Very few do more that look at an ear to determine its vitality. This is a great mistake and frequently results in a poor stand and a low yield. Without a perfect stand, the largest possible yield cannot be expected. If time is taken to count the stalks in one hundred consecutive hills, the average corn grower will doubtless be surprised to find far from a perfect stand. He will probably find not more than 75% or 80% of the stalks that should be there. With such a stand, and an allowance of from 5% to 10% for barren stalks, some explanation can be made for the low yield. There are on the average ear about 900 kernels suitable for seed. If, out of every hundred ears planted, four or five lack vitality, it will mean at least 2000 fewer stalks in the field per 100 seed ears planted.

## How Can One Determine Which Ears Will Not Grow ?

While ears having weak or dead kernels can sometimes be discarded by their general appearance, it is not always possible to detect them by this means. The only safe way is to plant the kernels and see if they will grow. This can be done by taking several kernels from each ear and planting them in a small box filled with sawdust, sand, or soil. A box 24x24 inches and 4 inches deep is a convenient size.

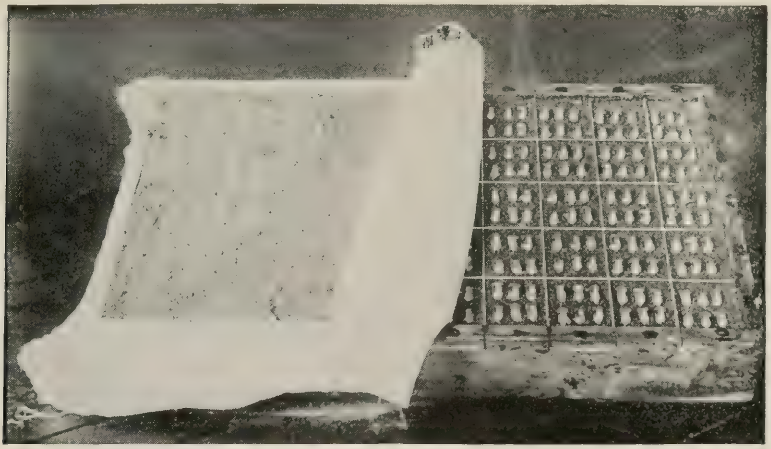


Method of lifting kernels from the ear preparatory to making test. Three ears on the left marked as described.

With a saw make notches one inch deep and two inches apart on the sides and the ends of the box. Put three inches of soil or sand in the box and press down firmly with a brick or the hand. By running cords from the notches both ways across the box the sand or soil will be marked off into two-inch squares. These squares may be numbered along one side by figures and along one end by letters. Six kernels from each ear should be tested. Hold the ear in the hand and with a knife remove a kernel about one inch from the butt. Turn the ear one sixth of the way around and remove another a little farther up. Continue in this way until six kernels are removed. Place the six kernels in one of the squares of the germinating box. The number of the square is then placed on a small piece of paper and with a pin fastened to the butt of the ear. When the box is filled, a cotton cloth is laid evenly over the kernels and another inch of damp sand or soil is placed on top of the cloth. In conducting the test, it is very essential that the germinator be placed as nearly as possible under *Field Conditions.* A temperature of 50° or 60° Fahrenheit in a building will correspond to the temperature of the soil at planting time. After a week or ten days, the cloth may be rolled back and the kernels examined. Any ear the kernels of which have failed to germinate perfectly should be discarded.

## How Shall This Corn be Prepared for Planting ?

It is best to shell seed corn by hand. The tip and butt grains should be discarded, since uniformity in shape and size of the kernels is necessary for accurate work of the planter. To still further increase the efficiency of the planter, it is well to select ears that are uniform in size and shape of kernel. The planter should be adjusted to each grade or size of kernels to insure an even stand in the field, since this is one of the most important factors in the production of a large yield.



A convenient box germinator. A sure method for detecting dead ears.

## When Is The Best Time To Plant Corn ?

The time for planting will vary according to the season and location. In most northern states, it has been found that, under average conditions, the largest yields are obtained from early planting, the exact date varying with the latitude and seasonal conditions. The Indians planted maize "when the leaves of the oak trees are the size of a squirrel's ears;" the assumption being that when the oak leaves are this size, the soil is warm enough to cause the seed to germinate.

### At What Depth Should Corn Be Planted?

The proper depth of planting will vary somewhat with the season and the type of soil. If the soil is a clay loam and there is plenty of available moisture, one inch will probably be the best depth. If the soil is light and open or the season dry, the seed must be planted deeper in order that it may obtain sufficient moisture to induce germination. At the College of Agriculture, Ohio State University, the best results have been obtained when corn was planted at a depth of one-and-a-half inches. Deep planting produces a weak, undesirable plant because most of the plant food in the kernel is used before the young plant comes through the soil.

### At What Rate Should it be Planted?

It has been found by experience that when corn is planted thinly, many suckers or tillers are produced. If planted thickly, the per cent of barren stalks is greater. At the Ohio Station, with the rate of planting varying from one to five grains per hill, and hills 42 inches each way, there was only a few bushels difference in the yield of 3, 4, and 5 stalks per hill. Four stalks per hill produced the largest yield. Two stalks per hill produced about 81% and three stalks about 95% as much as four grains.

Usually there is a noticeable difference in the size of the ear and the percentage of barren stalks in thick and thin planting. This is due, in a great measure, to the ability of the corn plant to adapt itself to existing conditions. If planted thinly, the plant in order to produce as much as is possible under existing conditions, produces large ears, more plants bearing two ears, and fewer barren stalks. If planted too thickly, the ears are smaller, the percentage of two-eared plants is lower, and the percentage of barren stalks is greater. Many prefer a high percentage of large ears rather than a large number of small ears and a few more bushels per acre. For good soil condition, a rate of three grains per hill and hills 36 by 42 inches should produce a high yield of grain. For less fertile soils two grains per hill may be a better rate at which to plant. In any case, if the maximum yield is desired, two extra grains should be planted in each hill and thinned to the desired number of stalks after the plants have reached a height of six or eight inches. This will help to secure a more nearly perfect stand.

### Shall it be Hilled or Drilled?

While drilling may give three or four more bushels per acre than the same number of grains planted in hills, it is often a question of whether the increase in yield will compensate for the extra labor necessary in keeping the field free from weeds.

## How Should Corn be Cultivated for Best Results?

Start prompt, thorough cultivation with the harrow or weeder as soon as the corn is through the ground and follow with persistant shallow cultivation throughout the season.

The principal objects of cultivation are (1) to save moisture, (2) to kill weeds and (3) to make plant food available.

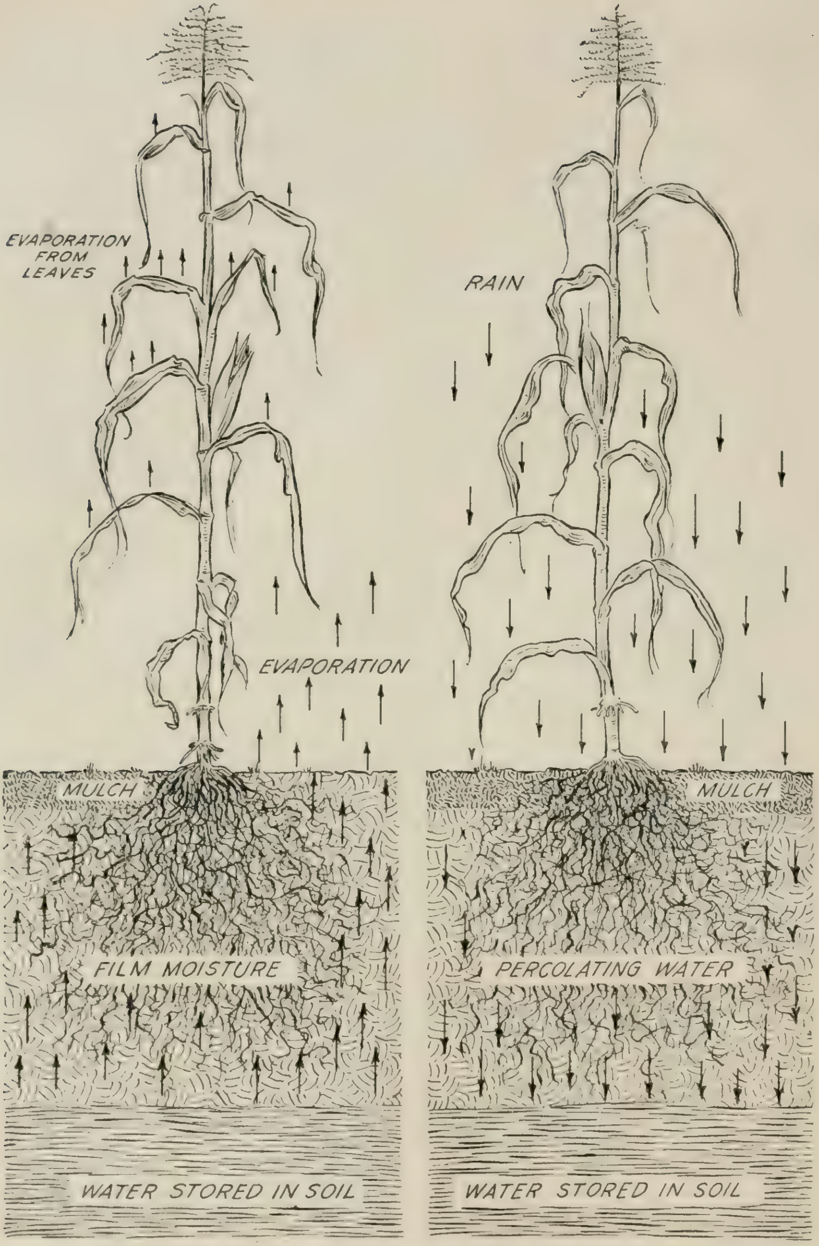
Cultivation by means of a weeder may begin three or four days after planting, or as soon as the weeds begin to come through the soil. This process should be repeated frequently, the principal object being to kill the weeds. Deeper cultivation with the cultivator should be given as the surface soil becomes compact, especially after every heavy rain.

From the time that the ear begins to form until it is nearly matured, a large amount of moisture will be required to supply the necessary food. This period will extend from the latter part of June to the middle of August. If this moisture is to be conserved, frequent cultivation must be continued as late as possible into the summer, even after the plant has tasseled.

A study of the development of the roots of the corn plant will disclose the facts that at first the roots are similar to tap roots which have a tendency to go down in search of moisture and food, and that gradually lateral roots are formed. In the course of sixty or seventy days, the soil will be filled with roots from hill to hill. If shallow cultivation has been practised, these roots will come near the surface of the soil where they will find the greatest amount of available plant food.

These facts teach us that after a heavy rain, the greater part of the water which enters the soil passes down through until it reaches a place where all of the openings between the soil particles are completely filled with free water. During the time between rains the plants must get their moisture from this supply deep down in the soil. The process by which this water rises in the soil is called capillarity. This capillary water is sometimes called film moisture, because it is spread out in a thin film over each soil particle.

If allowed to do so, much of this capillary water will pass up through the soil and be evaporated from the surface without having been of any service to the plants. To prevent this, shallow cultivation should be practised, which keeps a blanket over the surface of the



WATER IN THE SOIL

To the right the rain is soaking into the soil. It passes down into it by gravity and is stored for future use. During dry weather the water moves upward by capillarity to supply the plants as shown to the left. On one side of the plant a mulch prevents the loss of moisture while on the other side the water is being lost by evaporation at the crusted surface. The moisture saved by the mulch is free to enter the plant with dissolved food, which it leaves behind as it evaporates from the leaf surface.

soil. Have you ever noticed how moist the soil is under a stone or board, even when the surrounding ground is quite dry?

Frequent shallow stirring of the soil during the growing season, and especially in the time of drouth, will tend to produce a much better crop than if the work is neglected. In corn growing it is sometimes best to cultivate deep, early in the season, before the roots of the plants have gotten very far out in the soil, in order that the moisture may go deeper. But later in the season, the roots of the corn spread out into the space between the rows and almost completely fill the soil to within three or four inches of the surface. At this time deep cultivation cuts off the roots upon which the corn plants are depending for their food and water and a poor crop is the result.

Frequent stirring of the soil surface brings fresh air into contact with the soil particles and enables them to be more readily dissolved in the soil water.

An abundance of fresh air in the soil is also necessary to encourage the work of our little friends that live in the soil and are called bacteria. These little workers are invisable, but they are busy in the soil at all times during the summer, preparing food for our crops. If they have plenty of air, they can do their work much better than if they are deprived of air, as they must be in a hard, poorly tilled soil.

A man by the name of Jethro Tull, who lived in England a great many years ago, was the first man to teach the importance of thorough tillage. He found that his system of tillage increased the available plant food in a soil, so he said that "tillage is manure." He was, mistaken of course, in thinking that tillage added to the soil anything that was not already there, but we have since learned why his system of thorough tillage gave him large crops.

## Can Corn be Improved by Field Selection of Seed Ears?

Yes. We can greatly improve our corn if we fix in mind certain characters which have been found by experiment to be desirable and select seed ears from the plants which conform to the desired type. Practically all of our best varieties are the result of persistent selection in the field by men having in mind definite aims and ideals.

## What are Desirable Characters in the Corn Plant?

Good maturity, vigor and the ability to produce a desirable seed ear.

What farm boy is not familiar with soft corn—corn which has not ripened when the killing frosts of the middle or last of September come? While the farmer can use a little of such corn, it is not nearly as valuable as that which thoroughly matures before the frosts come.

In the selection of ears of corn for seed, it is important that only such ears be selected as have acquired the habit of ripening in time. Care should be taken not to select seed ears from plants or varieties that ripen a long time before hard frosts may be expected, for such plants and varieties will yield less corn than those which use the entire season.

What we might group under the word vigor is perhaps deserving of our second consideration. Every one is able to distinguish a vigorous plant from one lacking in vigor. The former will be noted for large circumference of stalk at the base, gradually tapering toward the top; for well developed brace roots, holding it in upright position; and for a large leaf development.

While we have good reason to expect that the vigorous plant will produce an ear of corn of good weight, this must be determined, not assumed. Occasional vigorous plants are barren; frequently they produce inferior ears. The weight of the ear is of great importance.

Yield of shelled corn per acre is, and probably always will be, the principal aim of the corn grower. To attain this end, he should select seed from the plants capable of producing the most shelled corn per acre. In order to estimate in the slightest degree the capabilities of corn plants growing in the field, careful attention must be given to the environment under which the plant is produced. Plants are what they are as a result of two forces, heredity and environment.

Very many, if not most productive plants, owe their superiority to immediate environment—extra food, sunlight, and moisture as a result of thin stand. Possibly four of every five ears of seed corn as ordinarily selected from the wagon or crib owe their excellence to this lack of competition. Some plants possess superior ability in the way of producing large ears as a result of heredity. Such plants can be determined with certainty only by means of what is known as the ear-row test. This test consists in comparing the relative productiveness of a number of ears of corn planted side by side, an ear to a row. This test is recommended to the reader.

However, the intelligent selection of seed corn in the field as maturity approaches is helpful if it takes into consideration the immediate environment; particularly the stand of plants. A plant growing in a hill with two other plants should be rated much higher for having produced an ear of a given weight than a plant growing in a hill by itself, soil conditions being the same.

In other words, the selection of seed corn should be made in the field where the growing plants may be considered in connection with their environment, and plants growing under less than normal stand or under extra-normal conditions of any sort should thereby be disqualified save in exceptional cases. We want to be as sure as possible that the excellence we observe is due to something wrapped up in the seed and not to something which happened to the seed, for, if we fail to make the same things happen, the excellence will disappear.

Weight of ear, when selected as indicated above, is much more significant than shape of ear, indicating, as it does, the productive ability of the mother plant. The same may be said of the importance of weight of ear as compared with the covering of the extremities—tips and butts—straightness of rows or even length and circumference of ear. However, length of ear is worthy of attention. Of two ears of equal weight, but differing in length and circumference, experiments thus far show that a premium should be placed upon length. Experiments have also shown that the total weight of an ear is a slightly better indication of the productive ability of a seed ear than the weight of shelled corn. The per cent of grain has not proved especially important. The final weight of ear should be determined after it has become thoroughly air dry.

In the selection of mother plants the position of the ear on the stalk should be noted and extremes avoided. Ears borne too high tend to pull the plants over as maturity approaches. They are also difficult to gather in standing corn.

A larger number of ears than are needed should be selected in the field so that later culling may leave the necessary amount of seed. It is well to leave the seed ears on the stalk until they are well matured and hardened. Plants bearing the selected ears may be marked by topping or with paint so that they may be noted and the ears saved at husking time.

In the final going over of the air-dried ears, the kernels should receive careful inspection. Good length of kernels when associated with good sized cobs results in large yields per acre, but length of kernel at the expense of diameter of cob does not give maximum yields. While length of kernel is desirable, if it consists mainly of a prolonged chaffy cap it is of little moment and may well be rejected.

The shape of the kernel should be such that the rows of kernels fit snugly together their full length. This means that they should gradually decrease in breadth from the crown to the tip, with edges straight. The kernel should not, however, come to a sharp point at the tip, but should have good breadth and thickness or the size of the germ will be restricted. It should be remembered that the germ is the most valuable part of the kernel from the standpoint of nutrition and is the home of the embryo plant. Thin, shrunken, sharp-pointed kernels are objectionable.

Attention has been called to the fact that heredity and environment are responsible for what we see as we look over a field of corn with its hundreds of thousands of individual plants, no two of which possess the same characters, the same possibilities. The work of the corn grower, young or old, is to determine that which is temporary or accidental and that which is hereditary.

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## PROBLEMS

1. An ear of seed corn has 20 rows of 45 grains each. If we allow one-third off for butts and tips how many hills of three grains each will this ear plant?

2. How many ears like the above will be required to plant one acre of corn of 3556 hills with three grains to the hill?

3. If each hill produces three ears each weighing ¾℔. what will be the yield per acre in bushels?

4. If there is a stalk missing in every other hill what will be the yield?

5. A field containing 8.1 acres yielded 239 bushels of marketable and 46 bushels of unmarketable corn. What was the yield per acre?

6. A worm fence (zigzag rail) occupies a strip of ground six feet wide. The field cannot be plowed closer than two feet from the fence. If this fence is 60 rods long and divides one field into two, how much ground cannot be cultivated?

7. How much would be lost if the fence were wire?

8. One bushel of ear corn occupies about 2¼ cu. ft. of space. How many bushels of ears can be stored in a crib 8 ft. x 10 ft. x 20 ft.?

9. A crib is 6 ft. wide and 10 ft. high. How long must it be to hold the corn from a 10 acre field that gives an average yield of 60 bushels per acre?

10. How many ears each weighing 10 oz. will it take to make 1 bushel of corn? Get the average weight of a number of ears in your father's crib. How many will it take to make a bushel?